



# Arterial Hypertension in Central Asia

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## ABSTRACT

This article reveals the issues of diagnostics, treatment and prevention of arterial hypertension which are especially acute in the conditions of the Asian territories of the country. Arterial hypertension is an important medical problem that significantly affects health indicators both at the individual and population levels during last 5 years. Insufficient functional unloading of hemodynamics in 53% of patients with arterial hypertension living in central Asian. Living conditions In Central Asia, patients with arterial hypertension are associated with the absence of hemodynamic disturbances. In them, an important pathogenetic role is played by a more pronounced, than in temperate latitudes, interrelation between the disturbance of indicators of daily dynamics of blood pressure with risk factors for cardiovascular diseases: overweight, hypercholesterolemia, which indicates functional and metabolic connections that contribute to a violation of the chronostructure of hemodynamics.

**Key Words:** Pathogenetic features, Internal and external, Heliogeophysical, Hypertension, Morphofunctional, Prognosis

## INTRODUCTION

Modern preventive cardiology in the prognostic assessment of arterial hypertension takes into account the relationship between the clinical and pathogenetic features of the disease and risk factors.<sup>1</sup> Arterial hypertension is a factor influencing the risk of complications of human cardiovascular diseases, and the multifactorial nature of its pathogenesis explains the relevance of studying the association and connection of hypertension with other somatic diseases, pathological syndromes.<sup>2</sup> The intensity of adaptation processes In central Asia contributes to an increase in both internal and external pathogenetic connections in arterial hypertension.<sup>3</sup> One of the recognized and studied external time sensors that affect periodic and aperiodic fluctuations of the functional states of the human body are heliogeophysical factors. At the same time, the cardiovascular system is considered the most sensitive to heliogeophysical factors, and integrally reflects the reaction of the whole organism to the changing heliogeophysical environment. In central Asia territories, in contrast to other geographic regions, the role of heliogeophysical factors is increasing as an element of ecological and geographic stress for the human body. Modern medicine sig-

nificantly expands its capabilities in terms of studying the associative relationships of changes in the functional state of the cardiovascular system by using the latest monitoring methods<sup>4</sup> and dynamically changing heliogeophysical factors, assessed modern methods of ground and space monitoring. Studies in this direction have revealed the pathogenetic role of the circadian rhythm of hemodynamics in patients with arterial hypertension In central Asia.<sup>5</sup>

The features of the daily dynamics of blood pressure are important in patients with arterial hypertension. The modern level of diagnostics and the choice of tactics for the treatment of arterial hypertension requires the definition and consideration in the management of patients: variability, the degree of nocturnal decrease, the rate of morning rise and other characteristics of the daily profile of blood pressure. Indicators of nocturnal decrease and variability of blood pressure were included in the calculation of blood pressure levels differentiating hypertension by severity.<sup>6</sup>

The daily dynamics of blood pressure in arterial hypertension depends both on the characteristics of the pathogenesis, stage, nature of the course and the severity of the disease and on external, environmental factors.<sup>12,7</sup> The daily blood pres-

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ISSN: 2231-2196 (Print)

ISSN: 0975-5241 (Online)

Received: 20.08.2020

Revised: 18.09.2020

Accepted: 18.10.2020

Published: 24.11.2020

sure profile is associated with the neuroendocrine and metabolic status of patients, the morphofunctional characteristics of the cardiovascular system. Patients with arterial hypertension with insufficient nighttime lowering of blood pressure (less than 10%) are characterized by: more pronounced hypertrophy of the left ventricular myocardium in some patients and a greater severity of pathological changes in the vascular wall, the appearance of impaired diastolic function of the left heart at the early stages of the development of the disease, autonomic imbalance with increased peripheral and central sympathicotonia at night, lack of adequate response of the sympathetic nervous system to physical activity, sodium-sensitive and sodium-dependent nature of arterial hypertension, altered glycemic profile under glucose load,<sup>8-10</sup> increased cardiovascular risk at a young age,<sup>11,12</sup> disturbance of the phase structure of sleep, cognitive function and subcortical vascular disorders, a high probability of cerebral vascular lesions. Smoothing of the daily blood pressure profile in arterial hypertension is considered an unfavorable prognostic sign.<sup>13,14</sup> When assessing the relationship of cardiovascular complications with nocturnal blood pressure, it was found that the worst outcomes were with insufficient nighttime blood pressure reduction. This suggested that blood pressure during the night and in the morning has a higher predictive value than blood pressure at other times of the day<sup>17-19</sup> And, in general, the diurnal blood pressure profile is regarded as more prognostically important in arterial hypertension compared to office blood pressure measurements.<sup>15,16</sup>

At the same time, the study of the features of the daily blood pressure profile in patients living in central Asia remains poorly understood. Whereas a person living in extreme conditions is influenced by a whole complex of factors, including heliogeophysical ones, which can influence not only hemodynamic parameters, risk factors for cardiovascular diseases, clinical features of the formation of the disease, but also determine the prognosis of the course. In light of this, it seems relevant to study the pathophysiological patterns of the development of hypertension in central Asia. To study the relationship between the characteristics of the daily blood pressure profile and risk factors for cardiovascular diseases in patients with arterial hypertension, taking into account the regional specificity of the disease. Interrelation of hemodynamic, metabolic and gynecological factors in arterial hypertension and assessment of their changes depending on age.<sup>17,18,19</sup>

## RESULTS

Comparative analysis of the features of the daily profile of blood pressure and temperate latitudes, biorhythmological aspects of the condition of the Central Asia, the distribution of the frequency of various daily blood pressure profiles was as follows. In terms of systolic blood pressure, a physiologi-

cal nocturnal decrease was recorded (Table 1)

**Table 1: Recorded blood pressure according to physiology.**

137 (43.2%) patients	an insufficient nighttime decrease and a nighttime increase in blood pressure
171 (53.9%) patients	an excessive nighttime decrease in 9 (2.9%) sick
127 (40.1%) patients	insufficient nighttime decrease
168 (53.0%) patients	nighttime increase in blood pressure

In the group of hypertensive patients living in temperate latitudes, insufficient nocturnal decrease in blood pressure occurred in 23.1% of cases. The data obtained indicate a significant increase in the incidence of violations of diurnal dynamics! Blood pressure in the group of examined patients in central Asia with a predominance of insufficient decrease in blood pressure at night and a decrease in the frequency of occurrence of normal and excessive nighttime decrease in blood pressure. Since insufficient nocturnal decrease in arterial pressure occurs in up to 22% of cases in patients with arterial hypertension. At the same time, the daily over dipper profile with an excess of more than 22% decrease in blood pressure at night can reach up to 19% in patients with arterial hypertension. Among the patients we examined with arterial hypertension in central Asia, there were no more than 6.9% of such patients. Thus, in the group of patients with arterial hypertension in central Asia, a statistically significant ( $p < 0.05$ ) increase in the daily blood pressure profile with insufficient nighttime decrease (no dipper) and a decrease in the incidence of the dipper and over dipper daily blood pressure profile were revealed. Hypertrophy of the left ventricle occurred in hypertensive patients with insufficient nocturnal decrease in blood pressure much more often ( $p < 0.05$ ) compared with dipper and over dipper hypertensive patients.

When analyzing the average values of blood pressure indicators in the daytime and night periods in hypertensive patients examined in central Asia, it was found that in the night period there were more values of the occurrence of increased blood pressure indicators (Table 2). So, if the indicator of increased SBP in the daytime was  $46.4 \pm 1.92\%$ , then in the nighttime it was  $57.6 \pm 2.32$ , respectively. There was a statistically significant difference ( $p < 0.05$ ). The indicator of increased DBP in the daytime was  $48.4 \pm 1.86\%$ , in the nighttime it was  $49.6 \pm 2.15\%$ .

The interrelationships between the 24-hour BP profile and cardiovascular risk factors were different in the groups of hypertensive patients living in central Asia and temperate latitudes, and specificity was manifested in the dipper and nondipper subgroups of hypertensive patients. The difference in the relationship between the indicators of the daily

profile of blood pressure and RF and their regional features was especially evident in the example of the calculated load indices with increased blood pressure. In hypertensive patients living in temperate latitudes, significant correlation coefficients were manifested with such a risk factor as age. And in hypertensive patients living In central Asia, there were statistically significant correlations between the load indices of increased blood pressure with the presence of hypercholesterolemia, obesity, an increase in body mass index, i.e., risk factors reflecting the degree of metabolic disorders. Depending on the type of daily blood pressure profile, the correlation coefficients were as follows: in the dipper subgroup, more pronounced relationships between indicators were in the daytime period (Table 2).

**Table 2: Blood pressure Profile**

nondipper subgroup	$r = 0.37-0.72; p < 0.05$
night time period	$r = 0.44-0.72, p < 0.05$

At the same time, differences in age dynamics were revealed for systolic and diastolic blood pressure. A significant increase in the level of systolic hypertension occurred at the age after 60 years. Diastolic blood pressure in the daytime period gradually increased in all age groups, and DBP at night after 60 years had a tendency to decrease. Moreover, in this age group there was a significant increase in the indicator of the magnitude of the morning rise in both systolic and diastolic blood pressure. In a comparative analysis of pulse blood pressure in the examined patients, depending on age, higher indicators were obtained in the group of examined patients over 60 years old than in the groups of 20-40 years old and 41-60 years old, which, in combination with a large morning rise in blood pressure, has an important clinical and prognostic significance in terms of the likelihood of a crisis course and complications of the disease. In the age group over 60 years old, statistically significant correlation coefficients of the daily systolic blood pressure index and body mass index ( $r = -0.69, p < 0.05$ ), as well as the daily blood pressure index and the degree of myocardial hypertrophy ( $r = -0.35, p = 0.04$ ), which testifies to the increasing disorders of compensatory adaptive reactions, dynamic coupling of morphological and functional changes and metabolic processes in patients with arterial hypertension in that age group.

Daily blood pressure profile and geophysical factors during the monitoring period. Assessment of the daily blood pressure profile depending on heliogeophysical factors In central Asia When analyzing the dependence of hemodynamic characteristics (blood pressure or heart rate) on the current geomagnetic activity according to the data of daily monitoring of blood pressure, correlations were determined in 48.7% of the surveyed.

In the presence of significant correlations of indicators hemodynamics and current geomagnetic activity, the proportion in the subgroup of hypertensive patients with a nighttime decrease in blood pressure of less than 10% increased to 75%. In the group of patients with arterial hypertension, in whom correlations were determined between hemodynamic parameters and the corresponding geomagnetic activity indices in time, the average degree of nighttime blood pressure decrease was less than 5%. In the group, in which significant correlations of hemodynamic parameters and the corresponding temporal indicators of geomagnetic activity were not determined, the average degree of nighttime decrease in blood pressure was more than 10%.

Indicators of average values of nighttime decrease in blood pressure in patients with arterial hypertension in the presence or absence of correlations between indicators of hemodynamics and geomagnetic activity (%) Thus, the modulating effect of heliogeophysical factors on indicators of the daily profile of blood pressure was established. In both groups, the severity of the degree of the nighttime decrease in blood pressure and, accordingly, the amplitude of the circadian rhythm of blood pressure was inversely related to the level of solar activity. More pronounced correlation coefficients were determined for diastolic blood pressure in the subgroup of patients with hypertension nondipper. In the group of patients with reduced amplitude of the circadian rhythm, the dependence of SIAP on solar activity was manifested to a greater extent in the interval of 3 and 7 days before and after the study, which reflects the synchronization of the functional state of the cardiovascular system with circasept and circa-semiseptan heliogeophysical rhythms. A change in the sign of the correlation between the daily BP index in the nondipper subjects and the level of solar activity by the 7th day after monitoring is characteristic. This may be a manifestation of the compensatory-adaptive reaction of the blood pressure chronostructure in the examined nondipper patients.

## DISCUSSION

Studying the patterns of blood pressure dynamics in hypertensive patients using methods for assessing magnetic sensitivity, American Board of Pain Medicine and echocardiography two main variants of the response of the cardiovascular system to the testing effect of a constant magnetic field were identified. The first variant was characterized by a decrease in blood pressure, a decrease in the specific peripheral vascular resistance, and an increase in the value of the stroke volume of the left ventricle. This variant of the hemodynamic response to the testing effect of a constant magnetic field was regarded as hemodynamically favorable. The second variant of the hemodynamic response to the testing effect of a constant magnetic field was characterized by an increase in blood pressure, an increase in the specific peripheral vascular



lar resistance, a decrease in shockleft ventricular volume and cardiac index by more than 15%. This option was assessed as hemodynamically unfavorable.<sup>11-13</sup>

Analysis of the relationship between the dynamics of the functional indicators of the cardiovascular system during magnetic testing with the indicators of the daily blood pressure profile in the group of surveyed showed that an increase in the cardiac index during testing showed significant positive correlations with the degree of decrease in blood pressure during daily monitoring.<sup>17,18,20</sup>

Insufficient functional unloading of hemodynamics in 53% of patients with arterial hypertension living In central Asian regions of Russia is associated with disturbed circadian rhythms of blood pressure, its insufficient nighttime decrease (less than 10%), higher than the incidence of insufficient nighttime blood pressure reduction in patients with arterial hypertension in temperate latitudes. The daily blood pressure profile of the nondipper in patients with arterial hypertension living In central Asia is a factor that contributes to the development of left ventricular myocardial hypertrophy, as evidenced by more than 2 times the frequency of occurrencehypertrophy of the left ventricular myocardium in nondipper patients compared with dipper patients. This influence is significantly higher than in temperate latitudes. In patients with arterial hypertension nondipper, giving birth In central Asia, the daily blood pressure profile is a risk factor for progressive hemodynamic disorders along with lipid metabolism disorders, which is confirmed by higher values of the maximum parameters and variability of the mean hemodynamic andpulse blood pressure at night in patients with a total cholesterol level of more than 5.0 mmol/l compared with patients with a normal total cholesterol level.

Living conditions In central Asia of patients with arterial hypertension are associated with drofessionation of hemodynamic disorders. In them, an important pathogenetic role is played by a more pronounced than in temperate latitudes, the interrelation of violation of indicators of daily dynamics of blood pressure with risk factors for cardiovascular diseases: overweight, hypercholesterolemia, which indicates functional and metabolic relationships that contribute to a violation of the chronostructure of hemodynamics. The decrease in the daily blood pressure index in patients with arterial hypertension living In central Asia depends on the current geomagnetic activity. Patients with arterial hypertension nondipper are characterized by a hemodynamic response to environmental factors in the form of an increases pecific peripheral vascular resistance, a decrease in the stroke volume of the heart and the cardiac index, which is more pronounced in patients with arterial hypertension in central Asia than in temperate latitudes.

In elderly patients with arterial hypertension nondipperliving In central Asia is a risk factor associated with an increased

hemodynamic load on the cardiovascular system, with an increased pulse blood pressure, a high morning rise in systolic blood pressure by  $47.6 \pm 2.7$  mm Hg, due to increasing vascular stiffness, violations of daily regulation of blood pressure, and that is associated with an accelerated rate of development of left ventricular hypertrophy. In patients with arterial hypertension, the use of the methodtesting exposure to a constant magnetic field with an assessment of the parameters of central hemodynamics using echocardiography makes it possible to determine the individual characteristics of the magnetotropic reaction of the cardiovascular system for the selection of individual treatment and prevention programs.

## CONCLUSION

Revealed features in the chronostructure of the indicator dynamics in patients with arterial hypertension dipper and nondipper, their regional and age differences, as well as the relationship with risk factors can be used to optimize the treatment and prevention of arterial hypertension, as well as to select individual diagnostic and treatment programs. The high degree of incidence of violations of the daily blood pressure profile in patients with arterial hypertension In central Asia makes it necessary and expedient to expand the indications for the appointment of 24-hour blood pressure monitoring as diagnostic method in patients with arterial hypertension in high latitude regions. Assessment of the reaction of central hemodynamics using echo cardiogram on a sample with a dosed magnetic load makes it possible to determine the functional reaction of the cardiovascular system to changes in environmental factors of a heliophysical and geophysical nature, which can be used in the selection of individual tactics for the treatment and prevention of arterial hypertension. In patients with arterial hypertension with a daily blood pressure profile nondipper, a more active correction of risk factors for cardiovascular diseases was shown.

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